



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

CONTROL SYSTEMS LABORATORY								
III Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEED14	Core	L	T	P	C	CIA	SEE	Total
		-	-	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45			Total Classes: 45			
Prerequisite: There are no prerequisites to take this course								

I. COURSE OVERVIEW:

The Control Systems laboratory course is indeed to train the students practically on the modelling, analysis and design of linear feedback control systems. This course deals with modelling of dynamical systems, and the control components and designing the compensator. The hands on training in the laboratory enable students to apply and modelling control principles in various areas of industrial applications.

II. COURSES OBJECTIVES:

The students will try to learn

- I The estimation of stability of dynamical systems using Digital simulation.
- II The various techniques of modeling and analyzing system's performance.
- III Design the time and frequency response of system by both classical and modern techniques

III. COURSE OUTCOMES:

At the end of the course students should be able to:

- CO1 Make use of the knowledge of digital simulation tool for system analysis with different standard Inputs.
- CO2 Model the dynamic systems in transfer function using digital simulation tool and validate the performance characteristics of motors.
- CO3 Analyze and select various electronics devices for improving system performance along with tuning mechanism in virtual environment.
- CO4 Experiment the types of compensation techniques for improving the system's accuracy.
- CO5 Analyze the system's stability in time and frequency domain by computing gain and phase Margin.

IV. COURSE CONTENT:

Week – 1: TIME RESPONSE OF SECOND ORDER SYSTEM

To obtain the time response of a given second order system with time domain specifications

Week – 2: TRANSFER FUNCTION OF DC MOTOR

Determine the transfer function, time response of DC motor and verification with digital simulation

Week – 3: AC SERVO MOTOR

Study of AC servomotor and plot its torque speed characteristics

Week – 4: EFFECT OF VARIOUS CONTROLLERS ON SECOND ORDER SYSTEM

Study the effect of P, PD, PI and PID controller on closed loop second order systems

Week – 5: COMPENSATOR

Study lead-lag compensator and obtain its magnitude, phase plots

Week – 6: TEMPERATURE CONTROLLER

Study the performance of PID controller used to control the temperature of an oven

Week – 7: DESIGN AND VERIFICATION OF OP-AMP BASED PID CONTROLLER

Implementation of PID controller using Op-Amps and verification using MATLAB

Week – 8: STABILITY ANALYSIS USING DIGITAL SIMULATION

Stability analysis using root locus, Bode plot, Polar, Nyquist criterions of linear time invariant system by digital simulation

Week – 9: STATE SPACE MODEL USING DIGITAL SIMULATION

Verification of state space model from transfer function and transfer function from state space model using digital simulation

Week – 10: LADDER DIAGRAMS USING PLC

Input output connection, simple programming, ladder diagrams, uploading, running the program and debugging in programmable logic controller.

Week – 11: TRUTH TABLES USING PLC

Study and verification of truth tables of logic gates, simple Boolean expressions and application to speed control of DC motor using programmable logic controller.

Week – 12: IMPLEMENTATION OF COUNTER

Implementation of counting number of objects and taking action using PLC.

Week – 13: BLINKING LIGHTS USING PLC

Implementation of blinking lights with programmable logic controller

Week – 14: WATER LEVEL CONTROL

Control of maximum and minimum level of water in a tank using PLC

V. REFERENCE BOOKS:

1. J Nagrath, M Gopal, "Control Systems Engineering", New Age International, 3rd edition, 2007.
2. K Ogata, "Modern Control Engineering", Prentice Hall, 4th edition, 2003.
3. Benjamin Kuo, "Automatic Control Systems", PHI, 7th edition, 1987.

VI. ELECGRONIC RESOURCES:

1. <https://www.ee.iitkgp.ac.in>
2. <https://www.iare.ac.in/>

VII. MATERIALS ONLINE

1. Course template
2. Lab Manual